Art. VII.—*Incandescent Lamps for Surgical and Microscopical Purposes.*

By Robert E. Joseph, Esq.

[Read 10th May, 1883.]

I claim your attention for a short time to-night to bring under your notice two of the latest adaptations of the incandescent lamp for use in scientific research—namely, for surgical and microscopical purposes.

The use of electricity for producing light for surgical purposes by heating inferior metals was attempted in 1851, 1853, 1854, and 1856 by various scientists. In 1867 Dr. Bruck, dentist, introduced an electric light apparatus for the use of surgeons, &c., and a little later a Dr. Mullot, in France, made a number of experiments in this direction, but with apparently very little success, all the apparatus having been so cumbersome to handle.

Trouvè, in 1879, introduced a more perfect apparatus, using platinum wire, flattened in the middle, and kept in a state of incandescence by means of a "Plante" secondary battery. This, however, appears to have been only partially successful.

The chief causes of failure in the cases mentioned arose, doubtless, from the use of troublesome and expensive apparatus, rendered necessary by the employment of a metal raised to incandescence with the unavoidable over-heating and constant fusion of the wire. In the apparatus now brought under your notice the metal wire has been replaced by a carbon filament enclosed in a vaçuum, and with ordinary care there is very little danger of over-heating or breaking it, some of the ordinary Swan lamps having been in use for 2000 hours.

In the *British Medical Journal* for 27th January, 1883, which I have no doubt has already been seen by many of our members, there is a paper on "The Illumination of Internal Cavities by Means of the Electric Light," by Dr. Oliver and J. B. Payne, from which I will merely read the following extract:—

"*Mr. Payne's report.*—Leiter's arrangement contains an electric lamp in which platinum wire is heated by means

of battery power, and rendered incandescent. The arrangement I made is of a much simpler construction, gives a perfectly pure light, and develops less heat. It consists of an electro-plated outer tube nine inches and a half long by eleven-sixteenths inch external diameter, glazed at one end with a stout piece of plate-glass, made perfectly secure and tight.

"A Swan's electric lamp is used—the filament of which is carbon, and rendered incandescent by means of battery power. It is hermetically sealed in a glass shade; and water, conveyed to and fro through very small brass tubes, is made to circulate round the lamp. The light from this lamp is perfectly pure, and exhibits the conditions of things in their true and natural colour. For prolonged observation I should prefer to use either a Grove's or Bunsen's battery, but in the demonstration just referred to four cells of a modified Léclanche battery were employed, and answered admirably. It is advisable to have as great a pressure as possible for the water supply, so as to ensure perfect circulation, and for this I suspended from a hook fixed near the ceiling of the room a tin can containing water, connecting it with the brass tubes by means of lengths of India-rubber tubing."

Dr. Lodge gives an account of an operation he performed with the use of the apparatus just described, and appears to have been impressed with its value.

For examining the mouth and throat the small Swan lamp appears most valuable, and it is also likely to prove a useful accessory for dentists, and to replace the somewhat cumbersome mirrors in use by them. A very small amount of battery power is required to obtain the necessary illumination. Probably in the surgery a form of "Gravitz battery," such as Sir William Thompson's, or a modified Léclanche, would be the most convenient, but where space is an object a small bichromate battery will give good results for a short time. The modified Léclanche exhibited will last without any attention, except adding a little water now and then, for at least twelve months, and will always be ready for use. It has, however, the drawback of polarising quickly, and therefore the lamp must not be kept in use for more than three or four minutes at a time without giving the battery a similar period for rest. Probably in many instances this form of battery would be sufficiently effective. For portable purposes, a small form of bichromate battery would

be the best, and would give a light lasting from twenty minutes to over an hour, according to the amount of solution that the cells were capable of holding. The next use to which the small incandescent lamp has been recently and successfully applied is to the microscope.

Mr. C. H. Stearn, who has been associated with Mr. Swan during the whole of his experiments with incandescent lamps, has just introduced several forms of lamps and apparatus for the purpose, and I cannot do better than to quote from a paper read by Mr. Stearn before the Royal Microscopical Society in January last.

"The length of the incandescent filament is $\frac{1}{10}$th of an inch; its diameter, $\frac{1}{166}$th of an inch; and its superficial area, about $\frac{1}{555}$th of a square inch. Two Bunsen cells, or four Léclanche's, are sufficient to render them fully incandescent; but for general purposes it will be best to use an additional cell, regulating the intensity of the light by means of the adjustable resistance attached to the base of the microscope.

"As the duration of the lamps is in an inverse ratio to the temperature at which they are maintained, it is desirable that the most intense light that the lamp will give should only be employed for a very short time, when a special effect is required—such, for instance, as for purposes of micro-photography. If the lamp is at other times used no brighter than is necessary to obtain a white light, and the current turned off when observation is not going on, the lamps will last a very long time, as experience has shown that a life of more than 2000 hours of continuous and brilliant incandescence is frequently exceeded by Swan lamps. It is possible to obtain a light of $2\frac{1}{2}$ candles from the tiny surface just mentioned, with an electro-motive force of $3\frac{1}{2}$ volts, and a current of $1\frac{1}{4}$ amperes. It would, however, at a safe temperature, give a light equal to one candle.

"As the source of light is almost a point, and the lamp can be brought very nearly into contact with the slide, a higher degree of obliquity of the illuminating rays can be obtained than by almost any other method; and hence black-ground illumination is shown with great beauty, and many of the diatoms display diffraction colours with unusual splendour.

"The resolution of test objects becomes very much simplified, as most of them can be resolved by the lamp alone, without any accessory apparatus."

I think it must be evident that the incandescent lamp must soon replace all other forms of lamps for microscopes. There is very little difference between the trouble of setting up and trimming the oil lamp usually employed and that of filling a small battery for use, whilst the difference in the quality of the light obtained would be a considerable gain to the microscopist. The battery to be used is the same as for the lamp for surgical purposes, and the particular form to be used must be regulated according to circumstances.

Whatever form of battery be used, it is always advisable to insert an artificial resistance in the circuit, so arranged as to be able, by turning a handle, to increase or diminish the light. This is especially desirable when using a battery which polarises easily, as at the commencement, with the battery fresh, there might be a risk of breaking the carbon filament, whilst, as the battery polarised, the light would gradually diminish in intensity. By means of the adjustable resistance the intensity of the light can be kept at a fixed standard for a considerable length of time, whilst by starting with a considerable resistance in circuit, and then gradually reducing it, there need be no danger of injuring the lamp by excess of current. Two forms of lamps are shown to-night —one on a stand to replace the ordinary lamp only; the other, and smaller one, is mounted on a stand with universal attachment, but, as can be readily seen, it could quite easily be attached direct to the microscope. Mr. Stearn suggests the use of three lamps permanently fitted to the microscope stand—one above the stage, one on the sub-stage, and one below for use with the polariscope; each lamp being controlled by a switch, could be turned off and on at pleasure. This, of course, would be a very perfect and convenient arrangement, but not economical; and probably an attachment, proposed by Mr. J. B. Payne, that can be readily fitted to either the stand condenser or to various parts of the stage with a small clamp, will find greater favour with microscopists.

Art. VIII.—*On Germs of Blennorrhagia.*

Translated by Mr. Rudall, F.R.C.S., from an Original Paper by Dr. Ecklund, of Sweden.

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